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PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

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in its capacity as elected Office

Date of mailing (day/month/year) 01 November 2000 (01.11.00)	
International application No. PCT/FI00/00241	**Applicant's or agent's file reference** VAL208PCT
International filing date (day/month/year) 23 March 2000 (23.03.00)	**Priority date** (day/month/year) 26 March 1999 (26.03.99)
Applicant PARNI, Petri et al	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

03 October 2000 (03.10.00)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Charlotte ENGER
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

937160

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NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

SEPPO LAINE OY
Itämerenkatu 3 B
FIN-00180 Helsinki
FINLANDE

Date of mailing (day/month/year)
12 October 2001 (12.10.01)

Applicant's or agent's file reference
VAL208PCT

IMPORTANT NOTIFICATION

International application No.
PCT/FI00/00241

International filing date (day/month/year)
23 March 2000 (23.03.00)

1. The following indications appeared on record concerning:

[X] the applicant [ ] the inventor [ ] the agent [ ] the common representative

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2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[X] the person [ ] the name [ ] the address [ ] the nationality [ ] the residence

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Teleprinter No.:

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

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The International Bureau of WIPO
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 :
D21H 25/12, D21G 3/00 // B05C 11/02

A1

(11) International Publication Number: WO 00/58555

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(30) Priority Data:
990684 26 March 1999 (26.03.99) FI

(71) Applicant *(for all designated States except US)*: VALMET CORPORATION [FI/FI]; Fabianinkatu 9 A, FIN–00130 Helsinki (FI).

(72) Inventors; and
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(74) Agent: SEPPO LAINE OY; Itämerenkatu 3 B, FIN–00180 Helsinki (FI).

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Published
With international search report.
In English translation (filed in Finnish).

(54) Title: COATED HOLDER AND ROD IN A ROD–TYPE WEB COATING APPARATUS

(57) Abstract

The invention relates to a rod doctor intended for metering the amount of coating mix applied to the surface of a moving web (5) of board or paper or to the applicator roll surface in a film–transfer coater and for leveling the applied coat, the rod doctor comprising a support frame element (2), a cradle (3) adapted into the support frame element (2), and a rod adapted to rotate in the cradle (3). The surfaces of the cradle (3) on which the rod (1) is adapted to rotate conformingly are coated by a surfacing layer (6) serving to improve the wear resistance and sliding friction properties of said surfaces.

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COATED HOLDER AND ROD IN A ROD-TYPE WEB COATING APPARATUS

The present invention relates to a rod doctor according to the preamble of claim 1.

In coating a web of paper or board, the coating mix is first applied to the surface of a moving web, whereupon the excess coating is removed from the surface of the web and the coating layer is smoothed. Finally, the excess moisture content of the coating is removed in dryers. In blade application, a doctor blade is used for metering the applied amount of coat and smoothing the surface of the applied coating. Also a rod doctor, an air doctor or different kinds of rolls or scrapers can be used in the metering of the coating mix.

In most cases, the doctor blade of a blade coater can be replaced by a doctor rod. The rod doctor comprises a framework, which extends over the cross-machine width of the paper/boardmaking machine and has connected thereto a flexible loading hose, and a cradle into which the doctor rod is rotatingly mounted. The rod is rotated in the cradle by means of a drive mechanism generally in a reverse direction to the travel direction of the moving web. Typically, the cradle is fabricated from a polymeric material, but may also be made from metal materials, for instance. Also the doctor rod may be made from a polymeric or metal material.

A problem generally occurring in conventional rod doctor constructions is vibration of the rod that makes the

applied coat layer uneven after leveling. Such vibration also causes clearly detectable pulsation in the running of the rod drive motors. A plausible cause of the vibration is the high friction between the cradle and the rod rotating therein. The amplitude of the vibration has also been found to increase as the paper/boardmaking machines become wider. To reduce the friction, the gap between the cradle and the rod can be filled with water that acts as a lubricant. However, the lubricating water may leak from the cradle into the coating mix thus diluting the coating and deteriorating the quality of the applied coat.

Another problem typically handicapping rod doctor assemblies is a rapid wear of the rod and its support cradle that also causes unevenness on the applied coat. Cradles made from urethane polymers have been found particularly prone to a fast wear. Attempts have been made to slow down the wear rate by means different ways, e.g., by coating the rod with a chromium, a glass/carbon-fiber or ceramic surface coatings, but these measures only serve to improve the wear resistance of the rod without exhibiting any essential reduction of the friction between the rod and the cradle.

It is an object of the present invention to overcome the drawbacks of the above-described prior art techniques and to provide an entirely novel type of rod doctor.

The goal of the invention is achieved by way of surfacing at least the cradle of the rod doctor by a thin surface coating layer. When necessary, a surface coating may also

be made on the rod that supportedly rotates in the cradle. The surface coating used herein is selected from a group of hard materials having good sliding and self-lubricating properties, whereby the coefficient of friction between the cradle and the rod rotating therein is reduced. By the same token, the vibration of the doctor is reduced and the wear of the rotating rod and its cradle is lessened. The coating layer may be fabricated using, e.g., so-called vacuum deposition techniques, one of which is physical vapor deposition.

More specifically, the leveling rod according to the invention is characterized by what is stated in the characterizing part of claim 1.

The invention offers significant benefits.

By virtue of the approach according to the invention, the sliding conditions between the rod and the cradle are improved, whereby the rod vibration and the problems associated therewith are reduced or even eliminated entirely. Due to the improved sliding properties, the drive mechanisms of a lower power rating than those of the prior art may be used for rotating the rod. The wear rate of the rod and its cradle is reduced resulting in less frequent need for leveling rod unit maintenance and giving a longer life. The rod can be rotated in its cradle without necessarily needing any lubricating water, whereby the web coating problems caused by water leakage are eliminated. Simultaneously, also the construction of the leveling rod unit is simplified, because no connections or other specific means for the lubrication water

circulation are required. The surface coating also serves to improve the corrosion resistance of the cradle and the rod.

In the following, the invention will be examined in greater detail by making reference to the appended drawings in which

Figure 1 shows a first embodiment of a rod doctor according to the invention having its cradle surfaced; and

Figure 2 shows another embodiment of a rod doctor according to the invention having both the cradle and the rod surfaced.

The leveling rod unit shown in figure 1 comprises support frame elements 2, 8 extending over the entire width of the paper/boardmaking machine and having a flexible loading hose 4 mounted therebetween. Into the support frame element 2 is adapted a cradle 3 having a rod 1 adapted to supportedly rotate therein. The rod 1 is rotated by means of a drive mechanism, typically reverse to the travel direction of a web 5 being coated. The rod 1 is pressed by means of the loading hose 4 against the web 5 being coated, whereby the excess coating mix applied to the surface of the web 5 is removed and the applied coating layer is smoothed.

The cradle 3 is covered by a surfacing layer 6 with a thickness typically varying from a few nanometers to a few tens of micrometers. Advantageously, the layer 6 is

selected from the group of hard materials exhibiting good sliding and self-lubricating properties.

As shown in figure 2, both the leveling rod cradle 3 and the rod 1 rotatingly mounted therein are provided with a surfacing layer 6, 7. The surfacing layer 7 serves to improve the wear resistance of the rod 1 and to reduce the coefficient of friction between the cradle 3 and the rod 1. The surfacing layer 7 of the rod 1 may be of the same material as that of the surfacing layer 6 of the cradle 3. Normally, the surfacing layers 6, 7 are made from different materials, whereby the seizing tendency and wear rate of the sliding surfaces are generally reduced.

The surfacing layers 6, 7 may be formed by means of, e.g., vacuum deposition techniques. One such vacuum deposition method is the so-called physical vapor deposition (PVD), wherein the deposition process is carried out under a vacuum or in a low-pressure chamber into which the gas-phase coating material is introduced. Conventionally, the coating material is vaporized by means of an electron beam or resistive heating. Transported in the gas phase, the coating material adheres to the surface of the object being surfaced. When required, the coating process can be performed at an elevated temperature of about 400-500 °C.

A surfacing layer fabricated by vacuum deposition techniques is comparatively thin; its thickness typically varies from 1 nm to 90 m. In spite of its infinitesimal thickness, the surfacing layer is entirely free from

pores and conforms without cracks to the contour of the object being coated as the layer is produced at an atomic layer deposition level. The substrate to be surfaced by vacuum deposition can be of almost any material such as a metal, stone, plastic or glass. The surfacing materials used herein are selected from the groups of metals, metal alloys, oxides, nitrides or carbides. Different kinds of surface coatings may vary vastly in terms of their properties.

The surfacing layers 6, 7 of the cradle 3 and the rod 1 may be, e.g., a silicon molybdenum alloy in which silicon makes the surfacing layer 6, 7 hard, while molybdenum gives the favorable self-lubricating and sliding properties. Another advantageous alternative as a surface coating is a vacuum-deposited layer of diamond (DLC, Diamond Layer Coating) having a hardness typically in the range of 6,000 - 10,000 HV. This coating is highly resistant to acids and bases. Furthermore, a diamond coating gives a very low coefficient of friction against most other materials. For instance, the coefficient of friction between steel and a diamond coating is typically 0.1 in a sliding contact of dry surfaces that is only one-fifth of the coefficient of friction between two sliding steel surfaces under similar conditions. Other advantageous surfacing layer materials in an embodiment according to the invention are chromium and cromium-teflon composition.

In addition to those described above, the invention may have alternative embodiments.

The technique used for applying the surface coating may be selected rather freely. Instead of using vacuum deposition, the coating process may be performed using, e.g., thermal spraying in which the coating material is molten into a hot plasma that is directed to impinge on the surface of the object to be coated. In thermal spraying, the coating materials are generally metals and plastics such as chromium, molybdenum or teflon. As the number of suitable materials for the surfacing layers 6, 7 of the cradle 3 and the rod 1 is vast, the coating material must be selected according to the requirements set by the intended application and other similar factors. The rod doctor according to the invention may be used for metering the amount of coating mix applied to the applicator roll surface in a film-transfer coater and for leveling the applied coat.

Claims:

1. Rod doctor intended for metering the amount of coating mix applied to the surface of a moving web (5) of board or paper or to the applicator roll surface in a film-transfer coater and for leveling the applied coat, the rod doctor comprising

- a support frame element (2),

- a cradle (3) adapted into the support frame element (2), and

- a rod (1) adapted to rotate in the cradle (3),

c h a r a c t e r i z e d in that the surfaces of the cradle (3) on which the rod (1) is adapted to conformingly rotate are covered by a surfacing layer (6) serving to improve the wear resistance and sliding friction properties of said surfaces.

2. Rod doctor according to claim 1, c h a r a c t e r - i z e d in that the rod (1) is covered by a surfacing layer (7) serving to improve the wear resistance and sliding friction properties of the rod.

3. Rod doctor according to claim 1 or 2, c h a r a c - t e r i z e d in that the thickness of the surfacing layer (6, 7) is from 1 nm to 90 μm.

4. Rod doctor according to any one of claims 1 - 3, c h a r a c t e r i z e d in that the surfacing layer

(6, 7) is of a silicon-molybdenum alloy.

5. Rod doctor according to any one of claims 1 - 3, c h a r a c t e r i z e d in that the material of the surfacing layer (6, 7) is of diamond.

6. Rod doctor according to any one of claims 1 - 3, c h a r a c t e r i z e d in that the surfacing layer (6, 7) is of chromium.

7. Rod doctor according to any one of claims 1 - 3, c h a r a c t e r i z e d in that the surfacing layer (6, 7) is of a chromium-teflon composition.

8. Rod doctor according to any one of foregoing claims, c h a r a c t e r i z e d in that the surfacing layer (6, 7) is made using a vacuum deposition technique.

9. Rod doctor according to any one of claims 1 - 4, c h a r a c t e r i z e d in that the surfacing layer (6, 7) is made using a thermal spraying technique.

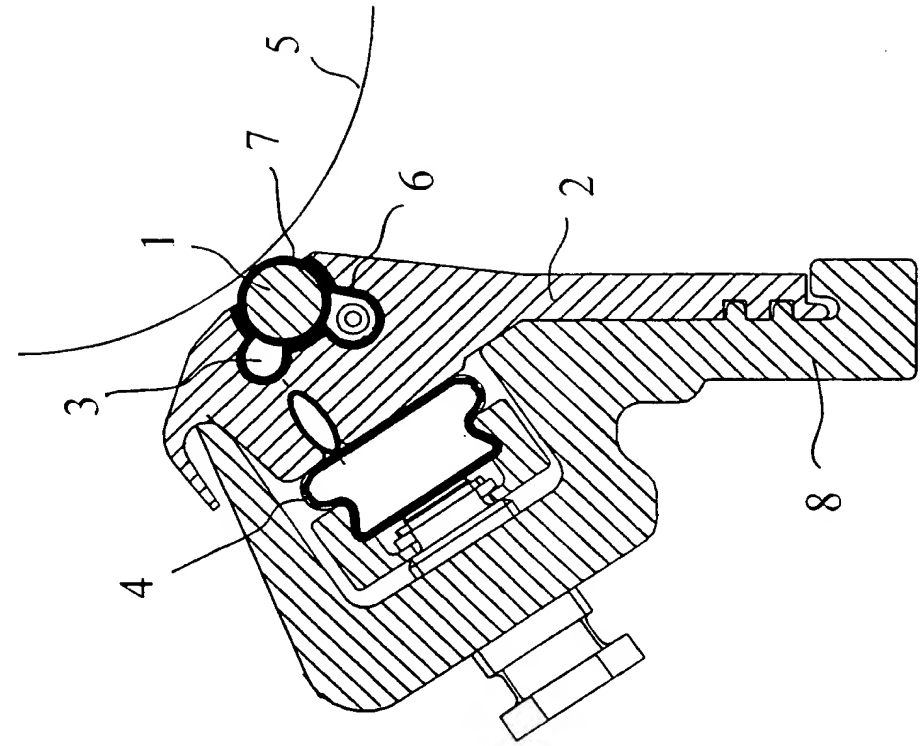

Fig. 2

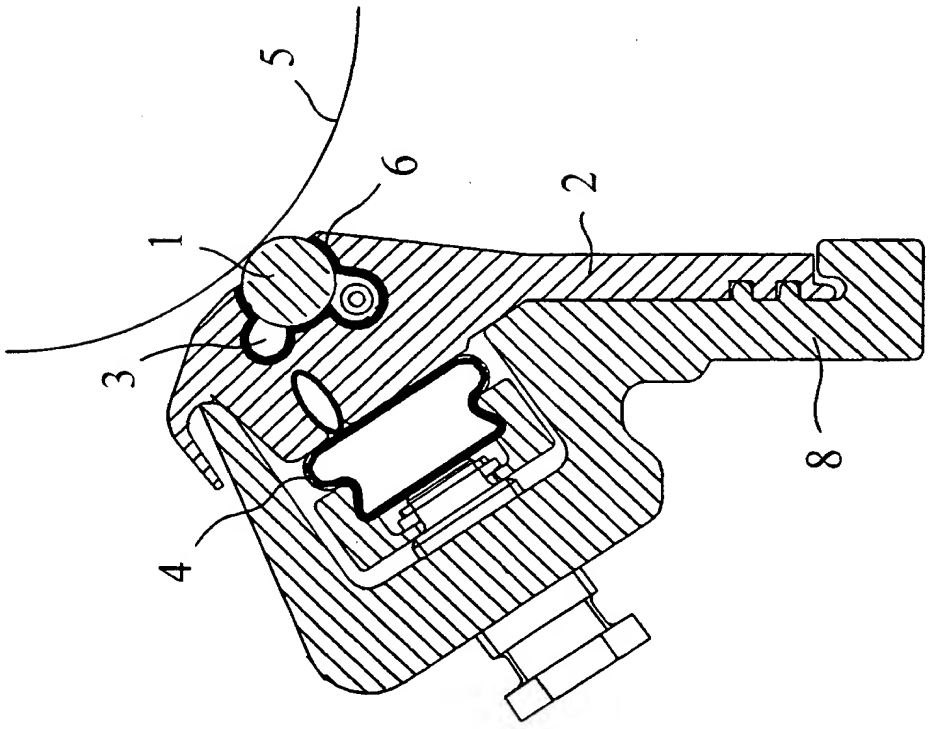

Fig. 1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 00/00241

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: D21H 25/12, D21G 3/00 // B05C 11/02
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: D21G, D21H, B41F, B05C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4245582 A (ALHEID ET AL.), 20 January 1981 (20.01.81), column 2, line 52 - line 59; column 6, line 65 - column 7, line 19, figure 1, claim 1, abstract	1
Y	column 2, line 52 - line 59; column 6, line 65 - column 7, line 19, figure 1, claim 1, abstract --	2,3,8
X	SE 377056 B (FELDMÜHLE ANLAGEN- UND PRODUKTIONS GMBH), 23 June 1975 (23.06.75), page 5, line 15 - line 36, claims 1,5 --	1

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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30 June 2000	20 -07- 2000
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 00/00241

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5264247 A (LINTULA), 23 November 1993 (23.11.93), column 2, line 11 - line 53, figure 1, claims 1,11	2,3,8
	--	
A	GB 1281931 B (BELOIT CORPORATION), 19 July 1972 (19.07.72), page 2, line 97 - line 105, claims 1-6	1-9
	--	
A	DE 19626580 A1 (JAGENBERG PAPIERTECHNIK GMBH), 8 January 1998 (08.01.98), figures 1-3, claims 1-5, abstract	1-9
	--	

INTERNATIONAL SEARCH REPORT

Information on patent family members

02/12/99

International application No.
PCT/FI 00/00241

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4245582 A	20/01/81	CA 1125003 A	08/06/82
		ES 488198 A	16/02/81
		GB 2040738 A,B	03/09/80
		IN 152703 A	17/03/84
		IT 1129792 B	11/06/86
		IT 8019445 D	00/00/00
		MX 149644 A	07/12/83
		PH 16390 A	20/09/83
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		DE 2007067 A,B	09/09/71
		FR 2078663 A	05/11/71
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		DE 2034004 A,B,C	20/01/72
		GB 1347107 A	27/02/74
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		US 5595601 A	21/01/97
		AU 6482396 A	30/01/97
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GB 1281931 B	19/07/72	BR 6915273 D	00/00/00
		DE 1962910 A	09/07/70
		ES 374699 A	16/01/72
		FI 50158 B,C	01/09/75
		FR 2026399 A	18/10/70
		SE 364089 B	11/02/74
DE 19626580 A1	08/01/98	NONE	

The demand must be filed directly with the competent International Preliminary Examining Authority if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

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CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only

Identification of IPEA	Date of receipt of DEMAND

Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION

Applicant's or agent's file reference: VAL 208 PCT

International application No.	International filing date *(day/month/year)*	(Earliest) Priority date *(day/month/year)*
PCT/FI00/00241	23 March 2000	26 March 1999

Title of invention: Rod doctor

Box No. II APPLICANT(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

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Teleprinter No.:

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Finland

State *(that is, country)* of nationality:	State *(that is, country)* of residence:
Finland	Finland

☐ Further applicants are indicated on a continuation sheet.

International application No.
PCT/FI00/00241

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The following person is [X] agent [ ] common representative

and [X] has been appointed earlier and represents the applicant(s) also for international preliminary examination.

[ ] is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.

[ ] is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

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[ ] **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special addr ess to which correspondence should be sent.

Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION

Statement concerning amendments:*

1. The applicant wishes the international preliminary examination **to start on the basis of:**

[X] the international application as originally filed

the description [ ] as originally filed
[ ] as amended under Article 34

the claims [ ] as originally filed
[ ] as amended under Article 19 (together with any accompanying statement)
[ ] as amended under Article 34

the drawings [ ] as originally filed
[ ] as amended under Article 34

2. [ ] The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.

3. [ ] The applicant wishes the start of the international preliminary examination **to be postponed** until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). *(This check-box may be marked only where the time limit under Article 19 has not yet expired.)*

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: English

[ ] which is the language in which the international application was filed.

[ ] which is the language of a translation furnished for the purposes of international search.

[X] which is the language of publication of the international application.

[ ] which is the language of the translation (to be) furnished for the purposes of international preliminary examinati n.

Box No. V ELECTION OF STATES

The applicant hereby **elects all eligible States** *(that is, all States which have been designated and which are bound by Chapter II of the PCT)*

excluding the following States which the applicant wishes **not to elect:**

Sheet No. 3.

International application No.
PCT/FI00/00241

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:			For International Preliminary Examining Authority use only: received	not received
1. translation of international application	:	sheets	☐	☐
2. amendments under Article 34	:	sheets	☐	☐
3. copy (or, where required, translation) of amendments under Article 19	:	sheets	☐	☐
4. copy (or, where required, translation) of statement under Article 19	:	sheets	☐	☐
5. letter	:	sheets	☐	☐
6. other *(specify)*	:	sheets	☐	☐

The demand is also accompanied by the item(s) marked below:

1. [X] fee calculation sheet
2. [ ] separate signed power of attorney
3. [ ] copy of general power of attorney; reference number, if any:
4. [ ] statement explaining lack of signature
5. [ ] nucleotide and or amino acid sequence listing in computer readable form
6. [ ] other *(specify)*:

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

For the Applicants

Seppo Laine Oy

Jyrki Nissinen

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:
2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):
3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply. ☐ The applicant has been informed accordingly.
4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue f Rule 80.5.
5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA n:

See Notes to the demand form

I[redacted]ENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference VAL 208 PCT	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/FI00/00241	International filing date *(day/month/year)* 23.03.2000	Priority date *(day/month/year)* 26.03.1999
International Patent Classification (IPC) or national classification and IPC7 D21H 25/12, D21G 3/00 // B05C 11/02		
Applicant VALMET CORPORATION et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of _____ sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
03.10.2000	29.06.2001
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Telex 17978 PATOREG-S Facsimile No. 08-667 72 88	Authorized officer Mattias Arvidsson/MP Telephone No. 08-782 25 00

Form PCT/IPEA/409 (cover sheet) (January 1998)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/FI00/00241

I. Basis of the report

1. With regard to the **elements** of the international application:*

☒ the international application as originally filed

☐ the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the claims:
pages _____, as originally filed
pages _____, as amended (together with any statement) under article 19
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the drawings:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the sequence listing part of the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language English which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☒ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.*

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/FI00/00241

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-9	YES
	Claims		NO
Inventive step (IS)	Claims	1-9	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-9	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The Invention relates to a rod doctor intended for metering the amount of coating mix applied to the surface of a moving web of a board or paper, or to the applicator roll surface in a film-transfer coating device, and for levelling the applied coat. The rod doctor comprises a support frame element, a cradle adapted to the support frame, and a rod adapted to rotate in the cradle.

The following documents are cited in the International Search Report as documents of particular relevance:

D1: US4245582 A
D2: SE 377056 B (=DE2007067 A)
D3: US5264247 A

Cited document D1 relates to a web coater metering rod holder, with resilient lip to adjust rod cavity bore and rod fit.

Cited document D2 relates to a coating unit used to coat lengths of paper or cardboard.

Cited document D3 relates to a coating bar manufactured by pre-profiling and boronising, to give a wear resistant ferrous boride coating.

Claims 1-9:

None of the cited documents discloses that the surfaces of the cradle, on which the rod is adapted to conformingly rotate, are covered by surface layers serving to improve the wear resistance and sliding friction properties of said surfaces.

.../...

Supplemental Box
(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V.

The surface layers according to the invention improve the sliding friction properties between the rod and the cradle in order to reduce the wear rate of the cradle.

Thus, the invention according to claims 1-9 is novel, considered to involve an inventive step, and have industrial applicability.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

12/

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
VAL 208 PCT		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/FI00/00241	23.03.2000	26.03.1999
International Patent Classification (IPC) or national classification and IPC7		
D21H 25/12, D21G 3/00 // B05C 11/02		
Applicant		
VALMET CORPORATION et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

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- I ☒ Basis of the report
- II ☐ Priority
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- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
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Date of submission of the demand	Date of completion of this report
03.10.2000	29.06.2001
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88 Telex 17978 PATOREG-S	Authorized officer Mattias Arvidsson/MP Telephone No. 08-782 25 00

Form PCT/IPEA/409 (cover sheet) (January 1998)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/FI00/00241

I. Basis of the report

1. With regard to the **elements** of the international application:*

☒ the international application as originally filed

☐ the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the claims:
pages _____, as originally filed
pages _____, as amended (together with any statement) under article 19
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the drawings:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the sequence listing part of the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language English which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☒ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

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☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.*

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/FI00/00241

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-9	YES
	Claims		NO
Inventive step (IS)	Claims	1-9	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-9	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The Invention relates to a rod doctor intended for metering the amount of coating mix applied to the surface of a moving web of a board or paper, or to the applicator roll surface in a film-transfer coating device, and for levelling the applied coat. The rod doctor comprises a support frame element, a cradle adapted to the support frame, and a rod adapted to rotate in the cradle.

The following documents are cited in the International Search Report as documents of particular relevance:

D1: US4245582 A
D2: SE 377056 B (=DE2007067 A)
D3: US5264247 A

Cited document D1 relates to a web coater metering rod holder, with resilient lip to adjust rod cavity bore and rod fit.

Cited document D2 relates to a coating unit used to coat lengths of paper or cardboard.

Cited document D3 relates to a coating bar manufactured by pre-profiling and boronising, to give a wear resistant ferrous boride coating.

Claims 1-9:

None of the cited documents discloses that the surfaces of the cradle, on which the rod is adapted to conformingly rotate, are covered by surface layers serving to improve the wear resistance and sliding friction properties of said surfaces.

.../...

Supplemental Box
(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V.

The surface layers according to the invention improve the sliding friction properties between the rod and the cradle in order to reduce the wear rate of the cradle.

Thus, the invention according to claims 1-9 is novel, considered to involve an inventive step, and have industrial applicability.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 00/00241

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: D21H 25/12, D21G 3/00 // B05C 11/02
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: D21G, D21H, B41F, B05C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, PAJ, EPO

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4245582 A (ALHEID ET AL.), 20 January 1981 (20.01.81), column 2, line 52 - line 59; column 6, line 65 - column 7, line 19, figure 1, claim 1, abstract	1
Y	column 2, line 52 - line 59; column 6, line 65 - column 7, line 19, figure 1, claim 1, abstract --	2,3,8
X	SE 377056 B (FELDMÜHLE ANLAGEN- UND PRODUKTIONS GMBH), 23 June 1975 (23.06.75), page 5, line 15 - line 36, claims 1,5 --	1

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 June 2000	20-07-2000
Name and mailing address of the ISA: Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer: MATTIAS ARVIDSSON/IPN Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 00/00241

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5264247 A (LINTULA), 23 November 1993 (23.11.93), column 2, line 11 - line 53, figure 1, claims 1,11	2,3,8
	--	
A	GB 1281931 B (BELOIT CORPORATION), 19 July 1972 (19.07.72), page 2, line 97 - line 105, claims 1-6	1-9
	--	
A	DE 19626580 A1 (JAGENBERG PAPIERTECHNIK GMBH), 8 January 1998 (08.01.98), figures 1-3, claims 1-5, abstract	1-9
	--	

INTERNATIONAL SEARCH REPORT
Information on patent family members

02/12/99

International application No.
PCT/FI 00/00241

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4245582 A	20/01/81	CA 1125003 A	08/06/82
		ES 488198 A	16/02/81
		GB 2040738 A,B	03/09/80
		IN 152703 A	17/03/84
		IT 1129792 B	11/06/86
		IT 8019445 D	00/00/00
		MX 149644 A	07/12/83
		PH 16390 A	20/09/83
SE 377056 B	23/06/75	AT 310547 A,B	15/08/73
		CH 536899 A	29/06/73
		DE 2007067 A,B	09/09/71
		FR 2078663 A	05/11/71
		JP 59049064 B	30/11/84
		NL 7102072 A	19/08/71
		US 3701335 A	31/10/72
		DE 2034004 A,B,C	20/01/72
		GB 1347107 A	27/02/74
		DE 2105704 A,B,C	14/09/72
US 5264247 A	23/11/93	FI 904541 A	15/03/92
		US 5595601 A	21/01/97
		AU 6482396 A	30/01/97
		EP 0837901 A	29/04/98
		WO 9701599 A	16/01/97
GB 1281931 B	19/07/72	BR 6915273 D	00/00/00
		DE 1962910 A	09/07/70
		ES 374699 A	16/01/72
		FI 50158 B,C	01/09/75
		FR 2026399 A	18/10/70
		SE 364089 B	11/02/74
DE 19626580 A1	08/01/98	NONE	

RECORD COPY

PCT REQUEST VAL208PCT

Original (for **SUBMISSION**) - printed on 23.03.2000 01:43:41 PM

0 0-1	**For receiving Office use only** International Application No.	PCT/FI00/00241
0-2	International Filing Date	23 MAR 2000 (23.03.00)
0-3	Name of receiving Office and "PCT International Application"	The Finnish Patent Office PCT International Application
0-4 0-4-1	**Form - PCT/RO/101 PCT Request** Prepared using	PCT-EASY Version 2.90 (updated 15.12.1999)
0-5	**Petition** The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	**Receiving Office (specified by the applicant)**	National Board of Patents and Registration (Finland) (RO/FI)
0-7	**Applicant's or agent's file reference**	VAL208PCT
I	**Title of invention**	ROD DOCTOR
II II-1 II-2 II-4 II-5 II-6 II-7 II-8 II-9	**Applicant** This person is: Applicant for Name Address: State of nationality State of residence Telephone No. Facsimile No.	 applicant only all designated States except US VALMET CORPORATION Fabianinkatu 9 A FIN-00130 Helsinki Finland FI FI +358-020 484 100 +358-020 484 101
III-1 III-1-1 III-1-2 III-1-4 III-1-5 III-1-6 III-1-7	**Applicant and/or inventor** This person is: Applicant for Name (LAST, First) Address: State of nationality State of residence	 applicant and inventor US only PARNI, Petri Kyrölänkatu 5 B 15 FIN-15200 Lahti Finland FI FI

PCT REQUEST VAL208PCT

Original (for **SUBMISSION**) - printed on 23.03.2000 01:43:41 PM

III-2	**Applicant and/or inventor**	
III-2-1	This person is:	applicant and inventor
III-2-2	Applicant for	US only
III-2-4	Name (LAST, First)	TAKKINEN, Atte
III-2-5	Address:	Kaarnapolku 4 A 13 FIN-04440 Järvenpää Finland
III-2-6	State of nationality	FI
III-2-7	State of residence	FI
IV-1	**Agent or common representative; or address for correspondence** The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV-1-1	Name	SEPPO LAINE OY
IV-1-2	Address:	Itämerenkatu 3 B FIN-00180 Helsinki Finland
IV-1-3	Telephone No.	+358-9-68 59 560
IV-1-4	Facsimile No.	+358-9-68 595 610
IV-1-5	e-mail	seppo.laine@selpat.fi
V	**Designation of States**	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AP: GH GM KE LS MW SD SL SZ TZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT

PCT REQUEST VAL208PCT

Original (for **SUBMISSION**) - printed on 23.03.2000 01:43:41 PM

V-2	National Patent (other kinds of protection or treatm nt, if any, are specified between parentheses after the designation(s) concerned)	AE AL AM AT (patent and utility model) AU AZ BA BB BG BR BY CA CH&LI CN CR CU CZ (patent and utility model) DE (patent and utility model) DK (patent and utility model) DM EE (patent and utility model) ES FI (patent and utility model) GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG SI SK (patent and utility model) SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW
V-3	National Patent (States which have become party to the PCT after the issuance of this version of EASY)	DZ (Algeria) AG (Antigua and Barbuda)
V-5	**Precautionary Designation Statement** In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.	
V-6	**Exclusion(s) from precautionary designations**	NONE
VI-1	**Priority claim of earlier national application**	
VI-1-1	Filing date	26 March 1999 (26.03.1999)
VI-1-2	Number	990684
VI-1-3	Country	FI
VI-2	**Priority document request** The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1
VII-1	**International Searching Authority Chosen**	Swedish Patent Office (ISA/SE)

VIII	**Check list**	number of sheets	electronic file(s) attached
VIII-1	Request	4	-
VIII-2	Description	6	-
VIII-3	Claims	2	-
VIII-4	Abstract	1	val208pct.txt
VIII-5	Drawings	1	-
VIII-7	TOTAL	14	

PCT REQUEST VAL208PCT

Original (for **SUBMISSION**) - printed on 23.03.2000 01:43:41 PM

	Accompanying items	paper document(s) attached	electronic file(s) attached
VIII-8	Fee calculation sheet	✓	-
VIII-9	Separate signed power of attorney	✓	-
VIII-16	PCT-EASY diskette	-	diskette
VIII-17	Other (specified):	Copy of official action	-
VIII-18	**Figure of the drawings which should accompany the abstract**		
VIII-19	**Language of filing of the international application**	Finnish	
IX-1	**Signature of applicant or agent**		
IX-1-1	Name	SEPPO LAINE OY	
IX-1-2	Name of signatory	Simo Hovi	

FOR RECEIVING OFFICE USE ONLY

10-1	**Date of actual receipt of the purported international application**	23 MAR 2000 (23 -03- 2000)
10-2	**Drawings:**	
10-2-1	Received	
10-2-2	Not received	
10-3	**Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application**	
10-4	**Date of timely receipt of the required corrections under PCT Article 11(2)**	
10-5	**International Searching Authority**	ISA/SE
10-6	**Transmittal of search copy delayed until search fee is paid**	

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11-1	**Date of receipt of the record copy by the International Bureau**	19 APRIL 2000 (19.04.00)

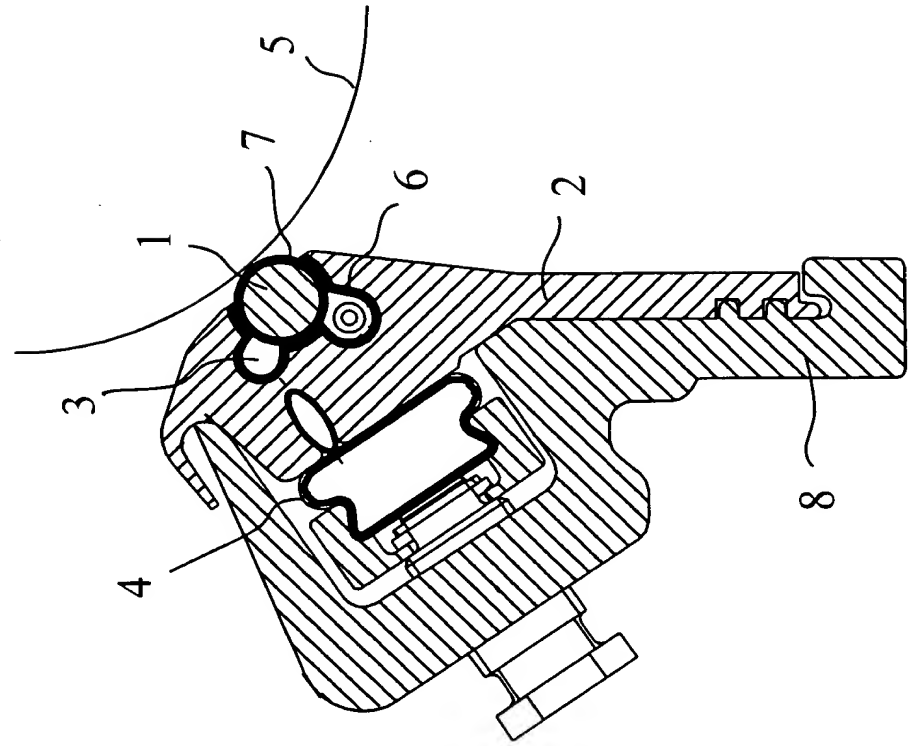

Fig. 2

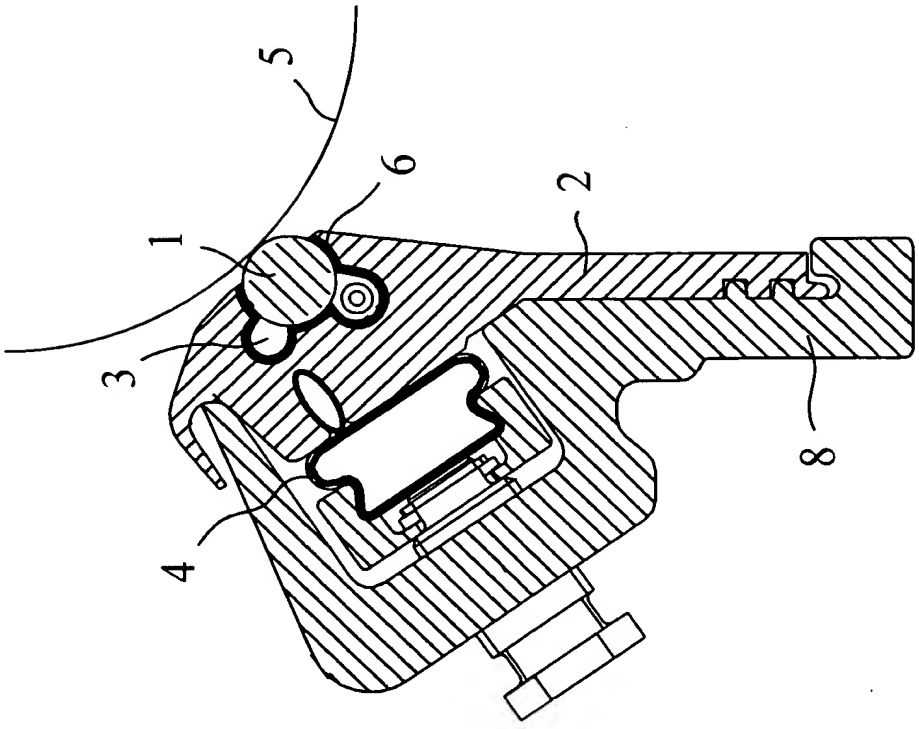

Fig. 1

Sauvakaavin

Tämän keksinnön kohteena on patenttivaatimuksen 1 johdannon mukainen sauvakaavin.

Paperia tai kartonkia päällystettäessä liikkuvan rainan pinnalle applikoidaan ensin päällysteseosta, minkä jälkeen ylimääräinen päällysteseos poistetaan rainan pinnalta ja päällystekerroksen pinta tasoitetaan. Lopuksi päällysteen joukossa oleva ylimääräinen vesi poistetaan kuivattimilla. Teräpäällystyksessä päällystemäärää säädetään ja päällystekerroksen pinta tasoitetaan kaavinterällä. Päällystemäärää voidaan säätää myös sauvakaapimella, ilmaharjalla tai erilaisilla teloilla tai kaavinlistoilla.

Useimmissa teräpäällystimissä kaavinterän tilalla voidaan käyttää sauvakaavinta. Sauvakaavin koostuu koko paperi- tai kartonkikoneen levyisestä runko-osasta ja siihen kiinnitetystä joustavasta kuormitusletkusta sekä kehdosta, johon kaapimen sauva on pyörivästi laakeroitu. Sauvaa pyöritetään kehdossa toimilaitteen avulla tavallisesti liikkuvan rainan kulkusuuntaa vastaan. Kehto on yleensä valmistettu polymeerista, mutta sen materiaalina voidaan myös käyttää esimerkiksi metallia. Myös kaavinsauvan materiaalina voidaan käyttää polymeeria tai metallia.

Tunnetun tekniikan mukaisissa sauvakaapimissa yleisesti esiintyvä ongelma on kaapimen värähtely, jonka takia kaavittavasta päällysteseoskerroksesta muodostuu epätasainen. Värähtely aiheuttaa myös sauvaa pyörittävien moottoreiden käyntiin selvästi havaittavaa nykimistä. Värähtelyn arvellaan johtuvan kehdon ja siinä pyörivän sauvan välisestä suuresta kitkasta. Värähtelyn on todettu lisääntyvän paperi- tai kartonkikoneen leveyden kasvaessa. Kitkan pienentä-

miseksi kehdon ja sauvan väliin voidaan johtaa vettä, joka toimii voiteluaineena. Voitelussa käytettävä vesi saattaa kuitenkin vuotaa kehdosta päällysteseoksen sekaan, jolloin päällysteseos laimenee ja päällystysjälki heikkenee.

Toinen sauvakaapimissa yleisesti esiintyvä ongelma on sauvan sekä kehdon nopea kuluminen, joka myös aiheuttaa päällystysjäljen epätasaisuutta. Erityisesti uretaanista valmistettujen kehtojen on todettu kuluvan nopeasti. Kulumista on yritetty vähentää mm. pinnoittamalla sauva kromilla, lasi- tai hiilikuidulla tai keraamisilla pinnoitteilla, mikä parantaa ainoastaan sauvan kulumisominaisuuksia, mutta ei oleellisesti paranna sauvan ja kehdon välisiä kitkaominaisuuksia.

Tämän keksinnön tarkoituksena on poistaa edellä kuvatun tekniikan puutteellisuudet ja saada aikaan aivan uudentyyppinen sauvakaavin.

Keksintö perustuu siihen, että ainakin sauvakaapimen kehto pinnoitetaan ohuella pinnoitekerroksella. Tarvittaessa myös kehtoon laakeroitu sauva voidaan pinnoittaa. Pinnoitteena käytetään kovaa, hyvät liuku- ja voiteluominaisuudet omaavaa materiaalia, jolloin kitkakerroin kehdon ja siinä pyörivän sauvan välillä pienenee. Samalla kaapimen värähtely sekä pyörivän sauvan ja kehdon kuluminen vähenevät. Pinnoitekerros muodostetaan esimerkiksi niin sanottuja tyhjiöpinnoitusmenetelmiä, kuten fysikaalista kaasufaasipinnoitusta käyttämällä.

Täsmällisemmin sanottuna keksinnön mukaiselle sauvakaapimelle on tunnusomaista se, mikä on esitetty patenttivaatimuksen 1 tunnusmerkkiosassa.

Keksinnön avulla saavutetaan huomattavia etuja.

Keksinnön mukaisen ratkaisun avulla sauvakaapimen sauvan ja kehdon väliset liukuominaisuudet paranevat, jolloin kaapimen värähtely ja siitä johtuvat ongelmat vähenevät tai poistuvat kokonaan. Parantuneiden liukuominaisuuksien ansiosta sauvaa pyörittävät toimilaitteet voivat olla teholtaan aiempaa pienempiä. Sauva ja kehto kuluvat hitaammin, minkä takia kaapimen huollontarve vähenee ja käyttöikä pitenee. Sauvan ja kehdon välissä ei välttämättä enää tarvitse käyttää voitelevaa vettä, jolloin vesivuodoista aiheutuvat ongelmat poistuvat. Samalla myös sauvakaapimen rakenne yksinkertaistuu, koska voiteluveden käsittelyä varten ei tarvita erillisiä yhteitä tai muita laitteita. Pinnoitteen avulla voidaan parantaa myös kehdon ja sauvan korroosionkestoa.

Keksintöä selitetään seuraavassa tarkemmin oheisten piirustusten avulla.

Kuvio 1 esittää yhtä keksinnön mukaista sauvakaavinta, jossa kehto on pinnoitettu.

Kuvio 2 esittää toista keksinnön mukaista sauvakaavinta, jossa sekä kehto että sauva on pinnoitettu.

Kuvion 1 sauvakaavin käsittää kartonki- tai paperikoneen levyiset runkokappaleet 2, 8, joiden väliin on asetettu joustava kuormitusletku 4. Runkokappaleessa 2 on kehto 3, johon sauva 1 on pyörivästi laakeroitu. Sauvaa 1 pyöritetään toimilaitteella tavallisesti päällystettävän rainan 5 kulkusuuntaa vastaan. Sauvaa 1 painetaan kuormitusletkulla 4 päällystettävää rainaa 5 vasten, jolloin rainan 5 pinnal-

le applikoitu ylimääräinen päällysteseos poistuu ja päällysteseoskerros tasoittuu.

Kehto 3 on päällystetty pinnoitekerroksella 6, jonka paksuus vaihtelee tyypillisesti muutamasta nanometristä muutamaan kymmeneen mikrometriin. Pinnoitteena 6 on edullista käyttää kovaa, hyvät liuku- ja voiteluominaisuudet omaavaa materiaali.

Kuviossa 2 sekä sauvakaapimen kehto 3 että siihen pyörivästi laakeroitu sauva 1 on pinnoitettu 6, 7. Pinnoitekerroksella 7 voidaan parantaa sauvan 1 kulumiskestävyyttä ja pienentää kehdon 3 ja sauvan 1 välistä kitkakerrointa. Sauvan 1 pinnoitekerros 7 voi olla samaa materiaalia kuin kehdon 3 pinnoite 6. Tavallisesti pinnoitteet 6, 7 ovat kuitenkin eri materiaalia, jolloin pintojen kiinnitarttuminen ja kuluminen on yleensä vähäisempää.

Pinnoitekerrokset 6, 7 voidaan muodostaa esimerkiksi tyhjiöpinnoituksella. Yksi tyhjiöpinnoitusmenetelmä on niin sanottu fysikaalinen kaasufaasipinnoitus (PVD, Physical Vapour Deposition), jossa pinnoitus tapahtuu tyhjiössä tai alipainekammiossa, johon kaasufaasissa oleva pinnoitemateriaali tuodaan. Pinnoitemateriaali höyrystetään tavallisesti elektronisuihkun tai resistiivisen kuumennuksen avulla. Kaasufaasissa oleva pinnoitemateriaali kiinnittyy pinnoitettavan kappaleen pinnalle. Tarvittaessa pinnoitus voidaan suorittaa korotetussa, noin 400-500°C:n, lämpötilassa.

Tyhjiöpinnoituksella valmistettu pinnoitekerros on melko ohut; sen paksuus vaihtelee tyypillisesti välillä 1 nm - 90 µm. Ohuudestaan huolimatta pinnoitekerros on täysin tiivis ja myötäilee pinnoitettavan kappaleen muotoja halkeilemat-

ta, koska pinnoite muodostetaan atomitason kasvumekanismilla. Tyhjiöpinnoituksella pinnoitettava materiaali voi olla lähes mitä tahansa materiaalia, kuten metallia, kiveä, muovia tai lasia. Pinnoitemateriaalina puolestaan käytetään esimerkiksi metalleja, metalliseoksia, oksideja, nitridejä tai karbideja. Eri pinnoitteiden ominaisuudet saattavat poiketa huomattavasti toisistaan.

Kehdon 3 ja sauvan 1 pinnoitteiden 6, 7 materiaalina voidaan käyttää esimerkiksi piimolybdeeniseosta, jossa pii antaa pinnoitteelle 6, 7 kovuuden ja molybdeeni hyvät voitelu- ja liukuominaisuudet. Toinen edullinen pinnoitevaihtoehto on tyhjiöpinnoituksella muodostettu timanttipinnoite (DLC, Diamond Layer Coating), jonka kovuus vaihtelee tyypilliseti välillä 6 000 - 10 000 HV. Pinnoite kestää hyvin happoja ja emäksiä. Lisäksi timanttipinnoitteen kitkakerroin on alhainen useimpia materiaaleja vasten. Esimerkiksi teräksen ja timanttipinnoitteen välinen kitkakerroin kuivassa liukukosketuksessa on tyypillisesti 0,1, joka on vain noin viidesosa kahden teräksen välisestä kitkakertoimesta vastaavissa olosuhteissa. Muita keksinnön mukaisessa ratkaisussa käytettäviä edullisia pinnoitemateriaaleja ovat kromi ja kromiteflonseos.

Keksinnöllä voi myös olla edellä kuvatusta poikkeavia sovellusmuotoja.

Käytettävä pinnoitusmenetelmä voidaan valita melko vapaasti. Pinnoitus voidaan suorittaa tyhjiöpinnoituksen sijasta myös esimerkiksi termisellä ruiskupinnoituksella, jossa sulassa tilassa olevaa pinnoiteplasmaa sumutetaan pinnoitettavan kappaleen pintaan. Termisessä ruiskupinnoituksessa pinnoitemateriaaleina käytttään yleensä metalleja ja muove-

ja, kuten kromia, molybdeenia tai teflonia. Kehdon 3 ja sauvan 1 pinnoitteiksi 6, 7 soveltuvia meteriaaleja on lukuisia, minkä takia sopiva pinnoitemateriaali on valittava tapauskohtaisesti mm. sovelluskohteelta vaadittavien ominaisuuksien mukaan. Keksinnön mukaista sauvakaavinta voidaan käyttää esimerkiksi myös filminsiirtopäällystimen telan pinnalla olevan päällystemäärän säätöön ja päällysteseoskerroksen tasoittamiseen.

Patenttivaatimukset:

1. Liikkumaan sovitetun kartonki- tai paperirainan (5) pintaan applikoidun tai filminsiirtopäällystimen telan pinnalla olevan päällystemäärän säätöön ja päällysteseoskerroksen tasoittamiseen tarkoitettu sauvakaavin, joka käsittää

   - runkokappaleen (2),

   - runkokappaleeseen (2) sovitetun kehdon (3), ja

   - kehtoon (3) pyörivästi laakeroidun sauvan (1),

   tunnettu siitä, että kehdon (3) pyörimään sovitettua sauvaa (1) vasten myötäilevästi sovitetut pinnat on pinnoitettu kulumiskestävyyttä ja liukuominaisuuksia parantavalla pinnoitteella (6).

2. Patenttivaatimuksen 1 mukainen sauvakaavin, tunnettu siitä, että sauva (1) on pinnoitettu kulutuskestävyyttä ja liukuominaisuuksia parantavalla pinnoitteella (7).

3. Patenttivaatimuksen 1 tai 2 mukainen sauvakaavin, tunnettu siitä, että pinnoitteen (6, 7) paksuus on 1 nm - 90 µm.

4. Jonkin patenttivaatimuksen 1 - 3 mukainen sauvakaavin, tunnettu siitä, että pinnoite (6, 7) on piimolybdeeniseosta.

5. Jonkin patenttivaatimuksen 1 - 3 mukainen sauvakaavin, tunnettu siitä, että pinnoite (6, 7) on timanttia.

6. Jonkin patenttivaatimuksen 1 - 3 mukainen sauvakaavin, tunnettu siitä, että pinnoite (6, 7) on kromia.

7. Jonkin patenttivaatimuksen 1 - 3 mukainen sauvakaavin, tunnettu siitä, että pinnoite (6, 7) on kromiteflon-seosta.

8. Jonkin edellä mainitun patenttivaatimuksen mukainen sauvakaavin, tunnettu siitä, että pinnoite (6, 7) on muodostettu tyhjiöpinnoitusmenetelmällä.

9. Jonkin patenttivaatimuksen 1 - 4 mukainen sauvakaavin, tunnettu siitä, että pinnoite (6, 7) on muodostettu termisellä ruiskupinnoitusmenetelmällä.

(57) Tiivistelmä:

Keksinnön kohteena on liikkumaan sovitetun kartonki- tai paperirainan (5) pintaan applikoidun tai filminsiirtopäällystimen telan pinnalla olevan päällystemäärän säätöön ja päällysteseoskerroksen tasoittamiseen tarkoitettu sauvakaavin, joka käsittää runkokappaleen (2), runkokappaleeseen (2) sovitetun kehdon (3), ja kehtoon (3) pyörivästi laakeroidun sauvan (1). Kehdon (3) pyörimään sovitettua sauvaa (1) vasten myötäilevästi sovitetut pinnat on pinnoitettu kulumiskestävyyttä ja liukuominaisuuksia parantavalla pinnoitteella (6).